NOTES

By John Preller, second officer American steamer *Tejon*, San Pedro to Balboa.—"March 28, 3 p. m., local time. In latitude 16° 56′ N., longitude 100° 36′ W., noted a mirage. The steamship *Empress of Scotland* passed about 5′ to the southward, and at times she appeared as if cut in two, her center disappearing, while at other times bow and stern were lost and only the middle showing. Sea smooth at the time. Sky clear. Variable winds during the day boxing the compass."

By W. H. Walker, master of the American steamer *Eelbeck*, Panama to Honolulu.—"On the passage of the American steamship *Eelbeck* from Panama Canal to Honolulu, on the great circle track, there was a complete absence of the northeast trade winds; the vessel passing through light variable winds and calms for 16 days. On the 28th of March, however, when in longitude 143° West, the ship met with strong winds from the southward, accompanied by a rough sea and heavy rain. This lasted for 15 hours, shifting to the west and northwest, bringing up a high head sea which continued to retard the vessel's progress until reaching the vicinity of the islands, when the sea moderated. This unusual weather delayed the ship 24 hours."

—*W. E. H.*

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DETAILS OF THE WEATHER IN THE UNITED STATES

GENERAL CONDITIONS

During the first half of the month the movement of cyclonic storms was mostly along the northern border but toward the end several rather intense storms developed in the far Southwest and moving across the central valleys passed off to sea. During the passage of one of these storms heavy snow fell over the southern Great Plains regions—Kansas to Texas. Another feature common to all of the months of 1926 was the great increase in energy of the cyclonic storms when reaching the Canadian Maritime Provinces and adjacent oceanic ares.

Temperature east of the Rocky Mountains, except over Montana and the Dakotas, was below normal several degrees as shown on Chart III; it was above normal by the same amount west of the Rockies. The usual details follow.—*A. J. H.*

CYCLONES AND ANTICYCLONES

By W. P. DAY

The first 12 days of the month were marked by generally high pressure over Canada and an accompanying succession of high-pressure areas from this region spreading southward over the United States. Five of the seven Alberta HIGHS were charted during this period. During the remainder of the month the HIGHS were more varied with respect to place of origin. The HIGH which appeared in the Northwest about the 25th was a combination of Alberta and North Pacific types.

Eighteen LOWS were plotted, several of which were quite important as storms. Of the latter, four were of the Texas type, i. e., secondaries developing over northeastern Mexico and southern Texas.

FREE-AIR SUMMARY

By V. E. JAKL

The free-air temperature departures at all aerological stations were negative (see Table 1) and as a rule increased somewhat with altitude. This departure aloft extended to some portions of the country where surface temperatures were above normal, as over North Dakota, where Chart III, this REVIEW, shows that it was warmer than normal. Over Ellendale a change to a negative departure took place at no great elevation above the ground, the average departure increasing with altitude to −3° C. at 4,000 meters. The greatest departure was at Royal Center, in the general vicinity of which the surface negative departure, as shown on Chart III, was also greatest. Relative humidities showed no important departure at any station.

Free-air winds were of more northerly component and greater velocity than normal, the general directions having been about northwest over middle sections of the country and more nearly west over eastern sections (see Table 2). Except at San Francisco, winds having a decided easterly component to high altitudes were almost absent, even over the most southerly stations. At San Francisco they were observed on 10 days scattered throughout the month. An exception is also noted at Ithaca, where a northeasterly wind was observed on the 21st to 10,000 meters.

Examples of wind velocity increasing rapidly with altitude as surface friction is surmounted are very common. However, instances of rapid increase are also occasionally observed that obviously can not be thus accounted for, as at Broken Arrow on the 2d. This observation showed a stratum of light northeasterly wind extending 800 meters above the ground, at the top of which the velocity fell to 1 meter per second. Immediately above this stratum, the wind changed abruptly to westerly and increased in velocity to 18 meters per second at 1,300 meters and to 32 meters per second in the next 3,000 meters. A somewhat similar condition is noted in the record of the afternoon two-theodolite pilot balloon observation at Groesbeck on the 26th, where a northeasterly wind extended with diminishing velocity to 2,000 meters, above which an abrupt change to southwesterly occurred, with rapid increase in velocity from 1 meter per second at 2,000 meters to 27 meters per second at 4,100 meters. In both cases a higher sea level pressure is found to the north or northeast of the station, which accounts for the northeasterly winds in the lower levels, and a general pressure and temperature situation over the country as a whole to account for the strong westerly winds in the upper levels, with evidently a sharp line of discontinuity intervening. Where an abrupt change in direction with altitude occurs, under ordinary conditions of fair weather, the velocities in the transition stratum are always very light.

An indication that surface friction over a not very rough terrain is ineffectual in causing turbulence to any perceptible height when the temperature is rising aloft is shown by the record at Drexel on the morning of the 17th, when a steady southerly surface wind of from 8 to 10 meters per second increased to 30 meters per second from the southwest 400 meters above the ground. The surface and aerological observations indicate that at the time of morning surface minimum temperature (−1.1° C.) the temperature increased steadily with altitude to 16.4° at 400 meters. As soon as insolation began the surface temperature rose rapidly to a maximum of 23.3° C. in 8 hours. If, before insolation began, turbulence had extended to any considerable height, a positive lapse rate would have been observed within that height.

The kite flights at Royal Center on the 16th and 17th show a change to higher free-air temperatures from one day to the next, the station on the first day being in front of a LOW and on the second under relatively higher pressure in the rear of a HIGH. A similar temperature change is noted in the Washington Naval Air Station airplane records of the 5th and 6th, where the change was

from a position in front of a HIGH to one of higher pressure just in the rear of its crest. These changes appear to be related to a condition which has been commented on before in connection with a rapid recovery of temperature which takes place above the northwestern stations in the colder season, after the crest of a cold HIGH has just passed and the air near the ground is still very cold.

The following record of the kite observation at Royal Center on the 31st is of interest because it was made in a snowstorm when the station was close to the center of the deep circular LOW that covered the eastern half of the country on that date. The temperature record shows conclusively that in this LOW there was no uninterrupted ascending current in the central region of the cyclone within the height limit of the observation.

Altitude m. s. l. (meters)	Temperature	At 100 m.	Relative humidity	Wind direction	Wind velocity
	° C.		Per cent		M. p. s.
225 (surface)	−1.3		98	WSW	15
850	−6.0	.75	100	WSW	21
1951	−9.3	.30	98	W	27
2327	−6.3	−.80	100	W	22
2758	−7.3	.23	100	W	

Aerological kite work was discontinued at Drexel at the termination of March 31, and no further kite records from that station will therefore appear after this issue of the REVIEW.

TABLE 1.—*Free-air temperatures, relative humidities, and vapor pressures during March, 1926*

TEMPERATURE (° C.)

Altitude m. s. l. (meters)	Broken Arrow, Okla. (233 meters)		Drexel, Nebr. (396 meters)		Due West, S. C. (217 meters)		Ellendale, N. Dak. (444 meters)		Groesbeck, Tex. (141 meters)		Royal Center, Ind. (225 meters)	
	Mean	Departure from 8-yr. mean	Mean	Departure from 11-yr. mean	Mean	Departure from 6-yr. mean	Mean	Departure from 9-yr. mean	Mean	Departure from 8-yr. mean	Mean	Departure from 8-yr. mean
Surface	8.1	−1.8	1.8	−1.2	8.9	−3.5	−2.7	0.0	10.6	−2.5	−0.8	−4.6
250	8.0	−1.8			8.6	−3.5			10.0	−2.5	−1.1	−4.7
500	6.6	−1.4	0.8	−1.6	6.6	−3.6	−3.1	−0.2	8.8	−2.5	−2.9	−4.5
750												
1,000												
1,250												
1,500												
2,000												
2,500												
3,000												
3,500												
4,000												
4,500												
5,000												

TABLE 1.—*Free-air temperatures, relative humidities, and vapor pressures during March, 1926*—Continued

TEMPERATURE (° C.)

Altitude m. s. l. (meters)	Broken Arrow, Okla. (233 meters)		Drexel, Nebr. (396 meters)		Due West, S. C. (217 meters)		Ellendale, N. Dak. (444 meters)		Groesbeck, Tex. (141 meters)		Royal Center, Ind. (225 meters)	
	Mean	Departure from 8-yr. mean	Mean	Departure from 11-yr. mean	Mean	Departure from 6-yr. mean	Mean	Departure from 9-yr. mean	Mean	Departure from 8-yr. mean	Mean	Departure from 8-yr. mean
750	5.4	−1.3	−0.8	−2.2	5.1	−3.6	−4.7	−1.1	8.2	−2.2	−4.3	−4.8
1,000	4.2	−1.7	−2.1	−3.0	4.2	−3.3	−5.7	−1.7	7.4	−2.3	−5.4	−5.1
1,250	3.1	−2.2	−3.5	−4.2	3.1	−3.2	−6.8	−2.2	6.8	−2.3	−5.9	−4.9
1,500	2.5	−2.1	−4.4	−4.7	2.1	−3.0	−7.7	−2.5	5.9	−2.5	−6.7	−4.9
2,000	0.5	−2.3	−5.3	−3.9	0.6	−2.3	−9.6	−2.7	4.4	−2.5	−8.2	−4.9
2,500	−1.7	−2.1	−7.7	−3.8	−1.9	−2.5	−11.5	−2.3	2.8	−2.0	−10.2	−4.7
3,000	−4.0	−1.8	−10.6	−4.1	−4.6	−3.0	−14.4	−2.5	0.0	−2.4	−12.7	−4.8
3,500	−7.0	−2.0	−13.3	−4.1	−7.6	−3.6	−17.4	−2.9			−16.1	−5.7
4,000	−10.1	−1.9	−15.9	−4.1	−10.0	−3.2	−20.2	−3.0			−19.0	−6.1
4,500	−12.3	−1.3	−19.0	−3.9			−22.1	−2.0			−22.0	−6.2
5,000			−22.2	−3.8			−24.0	−1.0				

RELATIVE HUMIDITY (%)

Surface	60	−4	61	−7	59	−3	64	−9	70	+1	74	+3
250	60	−4			59	−3			68	0	74	+3
500	60	−3	61	−6	59	−2	64	−8	63	−2	75	+5
750	61	−1	61	−4	58	−3	63	−4	58	−4	77	+9
1,000	64	+4	60	−1	56	−5	62	−1	56	−2	75	+10
1,250	62	+6	59	+3	55	−6	62	+3	57	+3	70	+8
1,500	59	+7	55	+3	53	−7	62	+5	58	+8	66	+6
2,000	54	+9	47	−3	49	−6	58	+3	55	+13	64	+7
2,500	45	+4	48	−2	49	−1	53	−1	51	+13	63	+7
3,000	40	+1	49	−2	46	+1	52	−2	49	+14	61	+6
3,500	36	−2	51	0	47	+5	49	−5			56	+5
4,000	31	−6	45	−5	46	+3	47	−5			51	+2
4,500	23	−12	43	−9			43	−8			59	+4
5,000			45	−5			41	−10				

VAPOR PRESSURE (*mb.*)

Surface	6.84	−1.38	4.36	−0.83	7.12	−2.35	3.28	−0.52	9.06	−2.12	4.51	−1.61
250	6.82	−1.33			7.01	−2.31			8.42	−2.24	4.45	−1.56
500	6.24	−1.02	4.11	−0.80	6.20	−2.13	3.19	−0.51	7.16	−2.38	3.89	−1.25
750	5.80	−0.74	3.77	−0.61	5.58	−1.97	2.82	−0.42	6.26	−2.36	3.59	−1.00
1,000	5.60	−0.41	3.38	−0.54	5.09	−1.85	2.58	−0.35	5.66	−2.03	3.28	−0.86
1,250	5.14	−0.29	3.05	−0.46	4.61	−1.74	2.39	−0.30	5.46	−1.30	2.88	−0.87
1,500	4.73	−0.11	2.66	−0.49	4.11	−1.55	2.24	−0.24	5.22	−0.70	2.53	−0.89
2,000	3.73	0.00	2.06	−0.58	3.40	−1.02	1.80	−0.31	4.45	+0.09	2.34	−0.58
2,500	2.77	−0.21	1.73	−0.51	2.80	−0.53	1.46	−0.29	3.60	+0.24	2.04	−0.47
3,000	2.08	−0.34	1.51	−0.38	2.18	−0.19	1.20	−0.21	3.02	+0.40	1.58	−0.54
3,500	1.32	−0.61	1.15	−0.40	1.80	+0.08	0.95	−0.19			0.79	−0.75
4,000	0.78	−0.74	0.67	−0.63	1.44	+0.08	0.88	−0.04			0.11	−1.09
4,500	0.36	−0.90	0.26	−0.85			0.82	+0.07				
5,000			0.01	−0.66			0.79	+0.16				

TABLE 2.—*Free air resultant winds (m. p. s.) during March, 1926*

Altitude m. s. l. (meters)	Broken Arrow, Okla. (233 meters)				Drexel, Nebr. (396 meters)				Due West, S. C. (217 meters)				Ellendale, N. Dak. (444 meters)				Groesbeck, Tex. (141 meters)				Royal Center, Ind. (225 meters)			
	Mean		8-year mean		Mean		11-year mean		Mean		6-year mean		Mean		9-year mean		Mean		8-year mean		Mean		8-year mean	
	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.
Surface	N.58°W.	1.8	S. 16°W.	1.8	N.34°W.	2.3	S. 71°W.	0.6	S. 81°W.	3.1	S. 73°W.	2.1	N.30°W.	3.2	N.41°W.	2.1	N. 13°E.	2.2	S. 14°E.	0.8	N.81°W.	1.9	S. 52°W.	1.6
250	N.63°W.	1.8	S. 14°W.	2.0					S. 81°W.	3.3	S. 72°W.	2.3					N. 16°E.	2.5	S. 11°E.	1.5	W.	1.9	S. 47°W.	1.8
500	N.72°W.	2.7	S. 18°W.	3.2	N.40°W.	3.0	S. 69°W.	0.9	S. 82°W.	6.0	S. 77°W.	3.5	N.32°W.	3.4	N.45°W.	2.1	N. 43°E.	2.0	S. 4°W.	3.0	N.88°W.	3.0	S. 55°W.	4.2
750	N.66°W.	3.6	S. 23°W.	4.0	N.50°W.	5.1	S. 85°W.	2.3	S. 85°W.	6.6	S. 78°W.	4.7	N.33°W.	4.0	N.66°W.	2.5	N. 10°E.	2.2	S. 21°W.	3.7	N.84°W.	4.2	S. 61°W.	5.4
1,000	N.65°W.	4.1	S. 35°W.	4.8	N.50°W.	6.5	N.86°W.	3.3	S. 88°W.	7.6	S. 77°W.	5.9	N.37°W.	4.4	N.73°W.	3.2	N.10°W.	2.9	S. 35°W.	4.2	N.78°W.	4.5	S. 68°W.	6.1
1,250	N.67°W.	5.0	S. 49°W.	5.6	N.47°W.	7.7	N.79°W.	4.3	N.87°W.	8.7	S. 79°W.	7.1	N.43°W.	5.0	N.71°W.	4.0	N.38°W.	3.3	S. 45°W.	4.7	N.83°W.	5.4	S. 75°W.	7.3
1,500	N.59°W.	6.0	S. 67°W.	5.9	N.38°W.	8.6	N.77°W.	5.3	N.86°W.	10.5	S. 80°W.	8.9	N.49°W.	6.2	N.73°W.	5.3	N.55°W.	3.8	S. 52°W.	5.0	N.72°W.	7.2	S. 83°W.	8.2
2,000	N.56°W.	8.0	S. 81°W.	6.9	N.28°W.	9.2	N.76°W.	6.7	N.86°W.	13.3	S. 83°W.	11.2	N.48°W.	8.0	N.73°W.	7.1	N.64°W.	6.1	S. 65°W.	6.4	N.70°W.	9.5	S. 86°W.	9.6
2,500	N.61°W.	9.2	N.89°W.	8.4	N.39°W.	11.6	N.80°W.	8.8	N.89°W.	15.7	W.	12.7	N.48°W.	9.6	N.73°W.	9.4	N.74°W.	8.6	S. 69°W.	8.6	N.74°W.	9.0	S. 88°W.	10.6
3,000	N.68°W.	11.5	N.84°W.	9.9	N.43°W.	12.6	N.83°W.	11.3	S. 89°W.	19.0	S. 85°W.	14.4	N.54°W.	13.8	N.74°W.	11.2	N.68°W.	9.6	S. 72°W.	9.5	N.71°W.	13.1	N.87°W.	13.5
3,500	N.74°W.	12.2	S. 86°W.	10.7	N.50°W.	15.2	N.79°W.	14.6	N.79°W.	21.2	S. 87°W.	14.5	N.65°W.	14.4	N.80°W.	12.8	N.22°W.	8.9	S. 75°W.	12.5	N.77°W.	14.7	N.89°W.	16.1
4,000	S. 73°W.	12.7	S. 78°W.	10.4	N.58°W.	15.3	N.75°W.	17.7	N.68°W.	23.2	W.	16.3	N.57°W.	9.8	N.83°W.	14.3					N.79°W.	15.4	S. 89°W.	15.2
4,500	S. 57°W.	15.8	S. 62°W.	12.3	N.45°W.	17.0	N.76°W.	17.3	N.68°W.	19.1	S. 88°W.	16.5	N.52°W.	8.5	N.87°W.	14.2					N.67°W.	16.0	N.89°W.	14.0
5,000	S. 67°W.	6.0	S. 58°W.	6.6	N.45°W.	19.0	N.67°W.	17.1					N.58°W.	9.7	N.83°W.	15.0								

TABLE 3.—*Mean free-air temperatures, relative humidities and vapor pressures and resultant winds during March, 1926, at Washington, D. C.*

Altitude m. s. l. (meters)	Naval Air Station (7 meters)			Weather Bureau (34 meters)	
	Temperature	Relative humidity	Vapor pressure	Direction of wind	Velocity
	°C.	Per cent	Mb.		M. p. s.
Surface	1.6	68	5.08	N. 55° W.	2.1
250	0.6	66	4.68	N. 68° W.	4.3
500	−0.2	64	4.33	N. 65° W.	3.1
750	−1.3	63	3.98	N. 66° W.	7.4
1,000	−2.5	63	3.73	N. 64° W.	8.4
1,250	−3.8	64	3.44		
1,500	−4.9	63	3.11	N. 68° W.	10.7
2,000	−6.8	61	2.51	N. 73° W.	11.6
2,500	−8.6	58	1.98	N. 70° W.	11.3
3,000	−11.0	55	1.56	N. 75° W.	13.0
4,500	−13.4	52	1.17	N. 59° W.	13.8
3,000	−16.6	51	0.89	N. 48° W.	15.0
4,500	−19.8	49	0.69	N. 52° W.	14.7

THE WEATHER ELEMENTS

By P. C. DAY, In Charge of Division

PRESSURE AND WINDS

The atmospheric circulation was distinctly sluggish for the first month of spring from the Rocky Mountains westward, no cyclone of importance entering the United States from the Pacific coast during the entire month, nor were anticyclones particularly active, though the pressure was moderately high over the far Northwest during much of the month.

East of the Rockies there were about the normal number of cyclones moving from the British Northwest, but they entered the United States somewhat farther east than usual and were mainly effective over the northern districts from the Great Lakes eastward. In one case, however, a storm entered the United States from the Canadian Northwest and moved directly toward the South Atlantic States, but it covered only a narrow area and caused little precipitation until after reaching the coast where it recurved to the Northeast and developed considerable importance after passing to sea. Several cyclones developed over the far Southwest or in the vicinity of the west Gulf and moved either directly toward the Great Lakes or pursued a more easterly course over the Gulf States and thence northeastward near the Atlantic coast.

Over a large area embracing the middle and northern portions of the Plateau and Great Plains there was little important storm activity.

The principal precipitation of the month was associated, as is usually the case, with the southwestern storms, though one of northern origin passing eastward over Lake Michigan on the morning of the 7th brought some heavy precipitation during that and the following day to the Ohio and middle Mississippi Valleys and over the Atlantic Coast States from the Carolinas to southern New England.

A cyclone giving important precipitation in the Gulf States, developed over southeastern Texas on the 10th and moving slightly northeastward reached the south Atlantic coast by the morning of the 11th whence it passed northeastward into the ocean without important development. The precipitation attending this storm ranged up to two inches or more over large areas in the Gulf and South Atlantic States.

A most unusual case of heavy rain without important evidence of cyclonic action occurred in the vicinity of New Orleans on the 20th, when in connection with a local thunderstorm nearly 6.50 inches of precipitation occurred in a period of less than 12 hours. Other southwestern storms giving precipitation of importance over the southern and eastern districts passed over those sections on the 22–24 and 25–27.

The most important storm developed over the far Southwest on the morning of the 29th and by the following morning the center had advanced to Arkansas whence it moved to northern Indiana by the morning of the 31st as a storm of wide extent and severe character. It was attended by heavy snows in the southern Rocky Mountain region and over a wide area thence northeastward to the Great Lakes, while heavy rains prevailed over large areas from Texas eastward to the South Atlantic States and northeastward to the Ohio Valley.

Snowfall, heavier than had occurred at any time during the winter, was reported from numerous sections from the Texas panhandle northeastward, the amounts being phenomenally heavy in portions of western and northern Illinois and near-by portions of other States High winds drifted the snow to such an extent that transportation was greatly hampered and in some instances suspended entirely for several days.

The average pressure was well above normal from the Southern Plains north and northeast to, and including, the western Canadian Provinces, and in most other portions of the country save California and from the Great Lakes and Ohio Valley east to the Atlantic coast, including the Canadian Maritime Provinces.

Compared with February just preceding, the average pressures were mainly higher, and decidedly so over the central valleys, the far Northwest, and the western Canadian Provinces. They were slightly lower than in February, over the Southwest and in California and portions of near-by States. Usually the average March pressures are below those of February in practically all parts of both countries.

The month was notably free from high winds over the western half of the country, particularly over the Pacific coast section where at a number of points the total wind movement was the least of record for March. In the central and eastern districts the first two decades were without important storms, but the last decade had some high winds, particularly in the Southwest during the early part of the decade and from Texas northeastward to the Great Lakes from the 29th to 31st. The details of these storms will be found in the table at the end of this section.

TEMPERATURE

The persistent mild temperatures which had featured much of the winter over large portions of the country were not found in March except in the far West, and in the last week a marked change occurred over the Rocky Mountain and Plateau States so that unseasonable cold prevailed thereafter almost throughout the country save in the Pacific and Atlantic States.

The first half of March brought a number of quick changes from cool weather to warm, or vice versa, in districts east of the Rocky Mountains, but was generally colder than normal over this area save in the northern half of the Plains, where the period was largely warmer than normal. The temperature deficiency was notable in the Ohio Valley and Pennsylvania and thence southward almost to the Gulf Coast, where this half-month averaged generally from 8° to 14° cooler than normal, while an excess nearly as great was prevailing at the same time in Montana and districts adjacent. In the latter part of the second decade the warmth became even more